# Illinois Department of Transportation, District 4, Peoria County LiDAR Acquisition

Metadata also available as

# Metadata:

- Identification_Information
- Data_Quality_Information
- Spatial_Data_Organization_Information
- Spatial_Reference_Information
- Metadata_Reference_Information

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*Identification_Information:*
*Citation:*
*Citation_Information:*
*Originator:* AeroMetric, Inc.
*Publication_Date:* 20130328
*Title:*
Illinois Department of Transportation, District 4, Peoria County LiDAR Acquisition
*Geospatial_Data_Presentation_Form:* remote-sensing image
*Publication_Information:*
*Publication_Place:* Sheboygan, WI
*Publisher:* AeroMetric, Inc.
*Description:*
*Abstract:*
This task order is for planning, acquisition, processing, and derivative products of LiDAR data to be collected for areas of Illinois. LiDAR data, and derivative products produced in compliance with this task order are part of the data to be obtained under Job Number P-94-025-10. Specifications listed below are based on the U.S. Geological Survey National Geospatial Program Base LiDAR Specification, Version 13.
*Purpose:*
LiDAR data was collected for the Illinois Department of Transportation. The Illinois Department of Transportation LiDAR Acquisition project is to acquire high accuracy bare-earth processed LiDAR data; to produce vector collection of water and drainage features, DAT files and Triangulated Integrated Network (TIN) files.
The data referenced is part of Illinois District 4 and refers to Peoria County in Illinois. Peroia County is 1632 square kilometers (623 square miles).
The project consisted of airborne acquisition, post-processing, classification of LiDAR data, collection of water and drainage and creation of final deliverable products. All areas are collected at a nominal pulse spacing (NPS) of 1.0 meters based on UTM16, related to

the North American Datum of 1983 HARN. Vertical accuracy was to achieve a RMSE Z of 0.6 feet or better in the "Open Terrain" land cover category.

*Time_Period_of_Content:*
*Time_Period_Information:*
*Range_of_Dates/Times:*
*Beginning_Date:* 20110405
*Ending_Date:* 20120212
*Currentness_Reference:* ground condition
*Status:*
*Progress:* Complete
*Maintenance_and_Update_Frequency:* As needed
*Spatial_Domain:*
*Bounding_Coordinates:*
*West_Bounding_Coordinate:* -89.991
*East_Bounding_Coordinate:* -89.444
*North_Bounding_Coordinate:* 40.975
*South_Bounding_Coordinate:* 40.510
*Keywords:*
*Theme:*
*Theme_Keyword_Thesaurus:* None
*Theme_Keyword:* Light Detection and Ranging
*Theme_Keyword:* LiDAR
*Theme_Keyword:* Breaklines
*Theme_Keyword:* Shapefiles
*Theme_Keyword:* Survey Control
*Theme_Keyword:* Lift
*Theme_Keyword:* LAS
*Theme_Keyword:* Swath
*Theme_Keyword:* Project
*Theme_Keyword:* DAT
*Theme_Keyword:* TIN
*Place:*
*Place_Keyword_Thesaurus:* None
*Place_Keyword:* US
*Place_Keyword:* State
*Place_Keyword:* IL
*Place_Keyword:* Illinois
*Place_Keyword:* Peoria
*Place_Keyword:* Peoria County
*Access_Constraints:* None.
*Use_Constraints:*

None. However, users should be aware that temporal changes may have occurred since this data set was collected and that some parts of this data may no longer represent actual surface conditions. Users should not use this data for critical applications without a full awareness of its limitations. Acknowledgment of the Illinois Department of

Transportation, Bureau of Design and Environment, would be appreciated for products derived from these data.

*Point_of_Contact:*
*Contact_Information:*
*Contact_Person_Primary:*
*Contact_Person:* Amy Eller
*Contact_Organization:* Illinois Department of Transportation, Aerial Survey Section
*Contact_Address:*
*Address_Type:* mailing and physical address
*Address:* 2300 South Dirksen Parkway, Room 005
*City:* Springfield
*State_or_Province:* IL
*Postal_Code:* 62764
*Country:* USA
*Contact_Voice_Telephone:* 217-782-4748
*Contact_TDD/TTY_Telephone:* unknown
*Contact_Facsimile_Telephone:* unknown
*Contact_Electronic_Mail_Address:* Amy.Eller@illinois.gov
*Hours_of_Service:* unknown
*Contact_Instructions:* none
*Data_Set_Credit:* AeroMetric, Inc.
*Native_Data_Set_Environment:*
1. Scanner - Optech Gemini 2. Processing Programs and versions - Applanix POSGPS and POSProc, versions 4.4, MMS version 5.2 3. Program and version - Optech ASDA 4. Processing Programs and versions - TerraSolid TerraScan (version 012.019), TerraModeler (version 012.008) and TerraMatch (version 012.011), Geopak (version 08.01.00.07), Intergraph MicroStation (version 08.05.02.70), and GeoCue (version 2012.1.27.4) 5. Viewing Program - GlobalMapper V12.00

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*Data_Quality_Information:*
    *Attribute_Accuracy:*
    *Attribute_Accuracy_Report:*
Project data was collected as one project including all counties of Illinois District 4. LiDAR data was placed into a tile layout and later divided by county boundaries. Ground survey check points were collected on a county basis by Lin Engineering, Inc for use in vertical accuracy evaluation. In vertical accuracy assessments the ground survey check points of the various ground cover categories are compared to a TIN of the LiDAR points, differences are measured to establish an RMSE.
*Logical_Consistency_Report:* None.
*Completeness_Report:* Complete
*Positional_Accuracy:*
*Horizontal_Positional_Accuracy:*
*Horizontal_Positional_Accuracy_Report:*
All data were acquired at or below 1600 meters above mean terrain (AMT) and have a horizontal accuracy of 0.30 meters (per manufacturers system specifications), with a nominal point spacing of 1.0 meters.

*Vertical_Positional_Accuracy:*
*Vertical_Positional_Accuracy_Report:*
The vertical accuracy of the data has a requirement to achieve a Fundamental Vertical Accuracy (FVA) of 18.2 ft at 95% confidence level based on an RSMEz x 1.960 in "open terrain" as defined by National Standards for Spatial Data Accuracy (NSSDA); assessed and reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines. Further, the data requires a Consolidated Vertical Accuracy (CVA) of 1.19 ft at 95th Percentile and a target value for Supplemental Vertical Accuracy (SVA) of 1.19 ft at 95th Percentile.

The ground survey data included many points categorized as 'Cross Section'. These points were used in evaluation against the TIN. The results are included in graphs in the Vertical Accuracy Assessment Report.

*Quantitative_Vertical_Positional_Accuracy_Assessment:*
*Vertical_Positional_Accuracy_Value:* 0.261 ft RMSEz .
*Vertical_Positional_Accuracy_Explanation:*
Tested RMSE of the Classified Points 0.261 ft in open terrain as tested against the TIN.
*Quantitative_Vertical_Positional_Accuracy_Assessment:*
*Vertical_Positional_Accuracy_Value:* 0.511 ft FVA.
*Vertical_Positional_Accuracy_Explanation:*
Tested FVA of 0.511 ft at the 95% confidence level in open terrain as tested against the TIN.
*Quantitative_Vertical_Positional_Accuracy_Assessment:*
*Vertical_Positional_Accuracy_Value:* 0.502 ft
*Vertical_Positional_Accuracy_Explanation:*
Tested 0.502 ft SVA at the 95th Percentile in the Hard Ground category against the TIN.
*Quantitative_Vertical_Positional_Accuracy_Assessment:*
*Vertical_Positional_Accuracy_Value:* 0.953 ft.
*Vertical_Positional_Accuracy_Explanation:*
Tested 0.953 ft SVA at the 95th Percentile in the Short Grass category against the TIN.
*Quantitative_Vertical_Positional_Accuracy_Assessment:*
*Vertical_Positional_Accuracy_Value:* 1.004 ft.
*Vertical_Positional_Accuracy_Explanation:*
Tested 1.004 ft SVA at the 95th Percentile in the Tall Grass category against the TIN.
*Quantitative_Vertical_Positional_Accuracy_Assessment:*
*Vertical_Positional_Accuracy_Value:* 0.510 ft.
*Vertical_Positional_Accuracy_Explanation:*
Tested 0.510 ft SVA at the 95th Percentile in the Brush category against the TIN.
*Quantitative_Vertical_Positional_Accuracy_Assessment:*
*Vertical_Positional_Accuracy_Value:* 0.716 ft.
*Vertical_Positional_Accuracy_Explanation:*
Tested 0.716 ft SVA at the 95th Percentile in the Woods category against the TIN.
*Quantitative_Vertical_Positional_Accuracy_Assessment:*
*Vertical_Positional_Accuracy_Value:* 0.766 ft.
*Vertical_Positional_Accuracy_Explanation:*
Tested 0.766 ft CVA at the 95th Percentile in all ground categories against the TIN.
*Lineage:*

*Process_Step:*
*Process_Description:*
The LiDAR data was acquired using AeroMetric's or a vendor's twin engine fixed wing aircraft equipped with LiDAR systems. The LiDAR systems include a differential GPS unit and inertial measurement system to provide superior accuracy.

Acquisition parameters:
1. Flight Height - 1600 meters above mean terrain (AMT)
2. Swath Width - 40 degrees
3. Sidelap - 50%
4. Nominal Post Spacing - 1.0 meters

GPS and IMU processing parameters:
1. Maximum baseline length - Not greater than 100 kilometers.
2. Number of base stations during LiDAR collection - A minimum of 1.
3. Maximum positional RMS of trajectory during LiDAR collection - 0.10 meters
4. IMU processing monitored for consistency and smoothness - Yes.

Point Cloud Processing:
1. Horizontal Datum - North American_1983/HARN
2. Horizontal Coordinates - NAD 1983 HARN StatePlane Illinois West FIPS 1202 in feet.
3. Vertical Datum - North American Vertical Datum of 1988
4. Geoid Model used to reduce satellite derived elevations to orthometric heights - NGS Geoid09.

LiDAR Processing:
1. Point Cloud data is imported to TerraScan in a Microstation V8 (V) CAD environment on a specified 2000 feet by 2000 feet tiling scheme.
2. Analyze the data for overall completeness and consistency. This is to ensure that there are no voids in the data collection.
3. Inspect for calibration errors in the dataset using the TerraMatch software by sampling the data collected across all flight lines and classifying the individual lines to ground. The software will use the ground-classified lines to compute corrections (Heading, Pitch, Roll, and Scale).
4. Orientation corrections (i.e. Calibration corrections) are then applied (if needed) to the entire dataset.
5. Automatic ground classification is performed using algorithms with customized parameters to best fit the project area. Several areas of varying relief and planimetric features were inspected to verify the final ground surface.
6. AeroMetric, Inc. performed Quality Assurance and Quality Control (QA/QC) for this project by comparing field observed points in 'open terrain' land cover category to LiDAR data set points. TerraScan's Output Control Report (OCR) was used to compare the QA/QC data to the LiDAR data. This routine searches the LiDAR dataset by X and Y coordinates finding the closest LiDAR point and comparing the vertical (Z) values to the known data collected in the field. Based on the QA/QC data, a bias adjustment was

determined, and the results were applied (if necessary) to the LiDAR data.

7. After the LiDAR data is finalized for vertical placement, a macro is run via TerraScan to output a dataset generated on a per swath basis as part of the final deliverables. All points of the swath are reclassified to class 0 during this step.

8. Each tile is reviewed for accuracy and consistency of the macro ground classification. During this phase, MicroStation is used to generate line work representing water bodies and rivers. Separate line work is also placed in instances where overpasses have blocked enough valid ground returns or water gave too few ground returns to reasonably portray the ground surface. A proprietary in-house software program is then run to drape the river line work in a flowing fashion. Contours are generated on the river breaklines to review monotonicity of the draped line work.

9. Once the automatic processing and the testing of LiDAR is complete, AeroMetric meticulously reviews the generated bare-earth surface data to ensure that proper classification was achieved as part of a Quality Control process. Point classification follows the standard established by The American Society for Photogrammetry and Remote Sensing (ASPRS) for LAS data:
Code 1 Processed, but unclassified / non-ground
Code 2 Ground
Code 7 Noise / Low Points
Code 9 Water
Code 10 Ignored Ground (Breakline proximity)

10. Final deliverables are generated and output to a client specified 2000 feet by 2000 feet tiling scheme.

11. On a per tile basis, data files and Triangulated Integrated Network (TIN) files are generated by processing the finalized line work along with bare earth LiDAR points through a Geopak marco. Subsequent files are reviewed for adherence and completeness to the data and tile layout used during the creation process.

*Process_Date:* 201207
*Cloud_Cover:* Unknown

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*Spatial_Data_Organization_Information:*
 *Direct_Spatial_Reference_Method:* Point

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*Spatial_Reference_Information:*
 *Horizontal_Coordinate_System_Definition:*
 *Planar:*
 *Grid_Coordinate_System:*
 *Grid_Coordinate_System_Name:* State Plane Coordinate System 1983
 *State_Plane_Coordinate_System:*
 *SPCS_Zone_Identifier:* 1202 Illinois State Plane West
 *Transverse_Mercator:*
 *Scale_Factor_at_Central_Meridian:* 0.999941
 *Longitude_of_Central_Meridian:* 90.1666
 *Latitude_of_Projection_Origin:* 36.66666
 *False_Easting:* 2296583.333

*False_Northing:* 0
*Planar_Coordinate_Information:*
*Planar_Coordinate_Encoding_Method:* coordinate pair
*Coordinate_Representation:*
*Abscissa_Resolution:* 0.01
*Ordinate_Resolution:* 0.01
*Planar_Distance_Units:* survey feet
*Geodetic_Model:*
*Horizontal_Datum_Name:* North American Datum of 1983/HARN
*Ellipsoid_Name:* Geodetic Reference System 80
*Semi-major_Axis:* 6378137
*Denominator_of_Flattening_Ratio:* 298.257222101
*Vertical_Coordinate_System_Definition:*
*Altitude_System_Definition:*
*Altitude_Datum_Name:* North American Vertical Datum of 1988
*Altitude_Resolution:* 0.1
*Altitude_Distance_Units:* feet
*Altitude_Encoding_Method:*
Explicit elevation coordinate included with horizontal coordinates

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*Metadata_Reference_Information:*
*Metadata_Date:* 20130325
*Metadata_Contact:*
*Contact_Information:*
*Contact_Organization_Primary:*
*Contact_Organization:* AeroMetric, Inc.
*Contact_Address:*
*Address_Type:* Mailing and physical address
*Address:* 4020 Technology Parkway
*City:* Sheboygan
*State_or_Province:* WI
*Postal_Code:* 53083-6049
*Country:* US
*Contact_Voice_Telephone:* 1-920-457-3631
*Contact_Facsimile_Telephone:* 1-920-457-0410
*Contact_Electronic_Mail_Address:* cguy@aerometric.com
*Hours_of_Service:* Monday through Friday 8:00 AM to 5:00 PM (Central Time)
*Metadata_Standard_Name:* FGDC Content Standard for Digital Geospatial Metadata
*Metadata_Standard_Version:* FGDC-STD-001-1998

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